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Customized Innovation Policy for Regions

An Empirical Analysis of Innovation Policies Supporting Digital Content Services and Intelligent Machinery in Finland

Abstract

This paper poses the question of whether innovation policies are customized to meet the different needs of different regions and industries. The research questions are: (a) are the investigated innovation initiatives context-sensitive and customized to the prevailing innovation problems and hence, also, to what extent do they focus on overcoming specific bottlenecks of the respective regional innovation system and address system failures hampering innovation; (b) have innovation policies aiming to support specific industries recognized the differences and, if yes, have they been customized accordingly? The paper discusses emerging forms of local/regional innovation policy using Finland and especially two different industries (intelligent machinery and digital content services) in three different kinds of regional innovation systems as cases in point. The empirical research is based on data gathered (a) through 40 interviews with Finnish innovation policy-makers and (b) 91 structured interviews with firm representatives. Additionally, (c) interview data from another study with 53 national level innovation policy makers is exploited. The empirical analysis shows that, in spite of a shared understanding about the generic principles of the innovation policy and the investigated local/regional policy, initiatives are clearly customized to serve the up to date challenges of the specific regions and industries.

Key words: Region, innovation, policy, digital business, intelligent machinery

1 Introduction

In the 2010s innovation policy has become an increasingly visible form of public policy. Simultaneously, there is a growing understanding that there are no one-size-fits-all innovation systems or policies in circulation (Tödtling & Trippl, 2005). Institutions framing both systems and policies that differ between many different types of regions and countries as well as innovation policies ought to be customized to suit better the needs of the region in question. For example, as noted by Asheim et al (2011), even in relatively small countries like the Nordic countries, there is no one shared formula for promoting innovativeness. Innovation policies and practices do not indeed vary only between countries and regions but also depending on their past paths, resources and policy-making styles.

It also seems that many studies treat issues related to innovation policy as if innovation systems and policies would automatically function well or adjust to many needs without conscious efforts and much organizing. As Uyarra (2010, 130) concludes, innovation scholars implicitly assume an unproblematic and straightforward translation of policy recommendations into the formulation of related policies. As she adds, in innovation system studies political and policy processes are often treated as given and consequently many of the innovation policy recommendations are surprisingly blind to the actual policy processes. Indeed, there are no well-defined policy problems waiting for the rational decision makers to address them, nor is there a series of ready-made solutions to the problems on the shelves of a 'policy tool-box and problem solution shop'. Innovation policy may rather be a complex process in which problems and solutions emerge from a myriad of ideas, interests and arguments.

Additionally, as pointed out by Asheim and Gertler (2005) and Asheim et al (2007), there is a need for a deeper understanding of the differentiated knowledge bases that firms and other organizations draw upon as inputs to their knowledge creation and innovation processes. They believe that by studying knowledge bases deeper insights into innovation processes and policies can be gained. This is important because if there is no optimal or one best way to promote innovation in different industries, innovation policies need to be adaptive and fine-tuned to fit the context they serve (Asheim et al, 2006). It might be too hasty to argue that fine-tuned innovation policies always lead to good results. This paper, however, does not address the question of how well fine-tuned innovation policies serve innovation performance and economic growth but explores whether the innovation policies are customized and if so, how and to what purposes. For the sake of clarity, we differentiate between fine-tuning, i.e. making small adjustments to policy in order to achieve the best or desired performance, and customization, i.e. adjusting something to suit a particular entity or task.

The paper discusses emerging forms of local/regional innovation policy (in the context of national policy) using Finland and especially two different industries (intelligent machinery and digital content services) in three different kinds of regional

innovation systems as cases in point (metropolitan, old industrial and organizationally thin; see Tödtling & Trippl, 2005). Instead of focusing on specific innovation policies and/or instruments this article aims to reveal the innovation policy dynamics at a local level. More precisely, the research questions are: (a) are the investigated innovation initiatives context-sensitive and customized to the prevailing innovation problems and hence, also, to what extent do they focus on overcoming specific bottlenecks of the respective RIS and address system failures hampering innovation; (b) have innovation policies aiming to support specific industries recognized the differences and, if yes, have they been customized accordingly? To answer these questions, in Section 2 the attention is targeted at the basic tenets of the innovation policy and in Section 3 innovation policy for regions is scrutinized. Section 4 turns the attention to the Finnish innovation policy. In Section 5, the cases, data and methodology are introduced and in the Sections 6 and 7 the main empirical observations are discussed case by case. Finally, Section 8 concludes the discussion.

2 The basic tenets of innovation policy

In his definition of innovation policy Edquist (2008, 5) fairly straightforwardly states that innovation policy is actions by public organizations that influence innovation processes. Edquist's definition reflects well the fairly general notion that policy is something states or other public actors produce to promote some aspect of economic and/or societal development. Innovation policy is usually seen to consist of explicit measures to promote the development, diffusion and efficient use of new products, services and processes in markets or various organizations (Lundvall & Borras, 2005, 37). It is generally accepted that innovation policy has wider objectives than science and technology policies while it incorporates elements of both of these. Consequently, innovation policy covers a wide range of initiatives that are linked to science, technology as well as innovation (Lundvall & Borras, 2005).

Lundvall and Borras (2005, 611-615) divide innovation policy into two main versions. The first, according to them, emphasizes non-interventionism and highlights the importance of focusing on 'framework conditions' instead of specific sectors or technologies. This approach speaks for generic innovation policies and does not recognize customized or fine-tuned innovation policies as such. As Lundvall and Borras (2005, 610) maintain, this line of policy thinking 'often goes with a vocabulary where any kind of specific measure gets grouped under the negative heading picking the winners'. The extreme version of this kind of innovation policy sees mainly basic research and general education as well as the protection of intellectual property as the only legitimate public activities and, as Lorenz and Lundvall (2006) show us, this view can be labelled as a narrow view on innovation and innovation systems. Consequently, the supply of innovation inputs and support instruments has been highlighted and the absorptive capacity of firms, specific needs of specific regions, behavioural characteristics as well as managerial capacities have been neglected for some time and

the system and its co-ordination have not been paid adequate attention either (Tödtling & Trippl, 2005, 1023).

Lundvall and Borras (2005) raise a systemic version of innovation policy as the second main version of innovation policy. It implies that most major policy fields, not only innovation policy, need to be considered in the light of how they contribute to innovation. Therefore, the main emphasis is on the entire system of innovation, boosting its functions as a whole and redesigning linkages within it and on what has also recently been labelled as a broad-based innovation policy (Edquist et al, 2009). The call for a broad-based or systemic innovation policy denotes that the so-called linear innovation policy flowing from science to technology to innovation is too narrow an approach in contemporary economies.

In the early 2000s, after pursuing fairly successful science-based/push innovation policy, Finland moved towards a broad-based innovation policy that stresses demand and users side by side with science and technology (Ministry of Employment and the Economy, 2008). The search for new approach builds on the two innovation modes introduced by Lorenz and Lundvall's (2006), i.e the science, technology and innovation mode (STI) and the doing, using and interacting mode (DUI) (for more about STI and DUI see Lorenz & Lundvall, 2006). The contemporary innovation policy of Finland draws explicitly upon these two innovation modes the aim being to sharpen policies for science, technology and innovation while at the same time broadening the innovation policy by taking up more demand and customer oriented policy instruments in the spirit of DUI mode of innovation (see Ministry of Employment and the Economy 2008). Finland has thus translated STI/DUI division into policy language.

Mytelka and Smith summarize the development of innovation theory by maintaining that innovation is no longer seen primarily as a process of discovery of new scientific or technological principles but rather as a non-linear process of learning (Mytelka & Smith, 2002, 1467). Consequently, the broad version of innovation policy is tightly coupled with the broad definition of an innovation system. It highlights the need also to understand experience-based knowledge and the role of customers and users in innovation systems, i.e. all those sources of knowledge that do not necessarily have much to do with the actual knowledge-creating organizations (i.e. research organizations and universities). All this points towards in-depth analyses of learning, knowledge resources, knowledge flows and joint, as well as separate, capabilities (Jensen et al, 2007; Malmberg & Maskell, 2006; Asheim et al, 2006; Martin & Sunley, 2002).

3 Steps towards local/regional innovation policy

There are several reasons to assume that localized and/or regionalized innovation policies have some advantages in solving specific issues. First, national innovation policies have a regional impact, whether intended or not, and it should be recognized. Second, there are not only regional differences in the quantity and quality of innovation activity or in the performance of the entire regional innovation system but also in the institutions framing

the action and choices made in the region (see for more Fritsch & Stephan, 2005, 1123-1124). For these reasons, 'best practice' policy measures that apply to all regions may not produce the desired results and, therefore, differentiated strategies and instruments are needed both to serve the specific regions and to achieve national-level goals more effectively.

Regional innovation systems and policies are more than just some kinds of prototypes of national innovation systems (Howells, 1999, 86; see also Prange 2008). Regional systems may be distinguished from national innovation systems by observed differences across regions in industrial structure, R&D and technology provision, policy initiatives, business service provision, governance structures and the institutional framework, particularly the nature and extent of the inter-relationships between key players (Oughton, Landabaso & Morgan, 2002). Of course, such approaches as innovative milieux (Camagni, 1995), clusters (Porter, 1990), regional innovation systems (Cooke, Uranga & Etxebarria, 1997) and learning regions (Florida, 1995), among others, have already shifted the attention towards networks, social capital, knowledge spillovers, territorial embeddedness of knowledge, etc. and hence the view on innovation policy has been regionalized and/or localized considerably. However, it should be kept in mind that in some countries and industries the firms' innovation partners and knowledge sources may also be quite similar irrespective of location and thus the innovation system may be more sectoral than regional by nature (Isaksen & Onsager 2010).

Local and/or regional contexts have also become more important in innovation policies because tacit knowledge is more easily transferred and new knowledge created in an environment where constant interaction and exchange are easier and cheaper (Oughton, Landabaso & Morgan, 2002, 101). Gertler (1995) argues that simply by being there firms can utilize the benefits of frequent, effective and often unplanned interaction that draws on common language, modes of communication, customs, conventions and social norms. For their part, Crevoisier and Hugues (2009) suggest that a knowledge economy is a vast global playground for different knowledge and different players to interact in complex production–consumption systems that are multi-locational in nature. Indeed, increasing attention has been paid to the dangers of lock-in situations in cases where the majority of linkages are internal to the region in question (Tödtling & Trippl, 2005; Grabher, 1993). Storper and Venables (2004) and Bathelt, Malmberg and Maskell (2004) emphasize both local interaction and interaction through trans-local linkages and hence there is a recognized need to establish extra-regional linkages to complement localized learning.

Even though Finnish science, technology and innovation policies appear to be more top-down (dominated by national policies) than bottom-up (being influenced by local developments) in nature, a long-term view reveals their co-evolutionary characteristics (Sotarauta & Kautonen, 2007). The various localities have for a long time been active and invested their own resources in what we nowadays label as local nodes in wider innovation systems, i.e. in infrastructure, local competencies, networks, etc. both directly

and indirectly. In spite of all the investments local government and other local and regional development agencies have made in the innovation capacity in their respective regions, the national innovation policy does not fully recognize the role of local and regional development efforts (Edquist et al 2009; OECD, 2010). Additionally, as Suorsa (2007) shows, regions are usually poorly, if at all, defined in the Finnish national innovation policies and regional innovation policy is, more or less, seen as an extension of national policies. Even though regional innovation policy was and is not officially defined, the Centre of Expertise Programme[i] (CoE) has for some time now clearly been customized to fit the local and regional circumstances.

There are additional efforts to link regions better into the national innovation policies. The flagship programs, the CoE and the Strategic Centre of Excellence in Science, Technology and Innovation[ii], are in principle national initiatives but their co-ordinating offices are located in selected city-regions. This reflects the current mode of operation in both the Finnish regional development and the innovation policies. Various national policies are formulated in co-operation between national, regional and local policy actors as well as representatives from firms, universities and other research centres. The actual implementation of the policy is carried out in a network connecting all the main players in Finland and co-ordinated by a selected city-region. These programmes focus on selected clusters and the instruments are customized accordingly; it is obvious that the Finnish innovation thinking favours customized innovation policies. Both the SHOK and CoE programme cover a wide range of measures depending on the industry and/or region in question. Below, instead of introducing the mechanics of the programmes we focus on revealing the dynamics of innovation and policy processes.

4 Regional innovations system types and knowledge bases

In their influential article Tödtling and Trippl identify three different types of regional innovation systems (RIS) that are differentiated by their main deficiencies. They are organizationally thin RIS, locked-in RIS and fragmented RIS. They further associate these RIS types with specific types of regions: peripheral regions (organizational thinness), old industrial areas (lock-in) and metropolitan regions (fragmentation) (Tödtling & Trippl, 2005, 1207). Of course, as Tödling and Trippl (2005, 1209) also maintain by themselves, there is no exclusive correspondence between different types of innovation problems and the three types of regions they identify. In practice regions face a mix of deficiencies. In this study, in addition to these RIS types, we also use two of the three knowledge bases identified by Asheim and Coenen (2005), Asheim and Gertler (2005), Asheim et al (2007) and Gertler (2008) and distinguish between analytical, synthetic and symbolic knowledge bases. Most industries draw upon all three knowledge bases but the assumption is that more often than not one of them is at the core of competitiveness and the other knowledge bases support effective utilization of the core knowledge base.

An analytical knowledge base, which is not a target of attention in this paper, is based on innovation created from new knowledge, dominated by codified, mainly scientific knowledge, usually based on deductive processes and formal models that can also be relatively easily transferred from context to context. A synthetic knowledge base is based on novel combinations of existing knowledge that is often constructed in interactive learning processes among firms, customers, clients, research organizations and even competitors. Here, tacit knowledge is more dominant than codified knowledge even though both may be needed. Synthetic knowledge base stress the importance of applied, problem-solving, focused knowledge that is more inductive than deductive in nature and typical of engineering industries (Asheim et al, 2007, 661).

A symbolic knowledge base enables innovation by recombining existing knowledge in new ways. It introduces craft and practical skills as important sources of new knowledge and it also highlights the importance of learning through interaction in professional communities. It is clearly more culturally oriented than the other two knowledge bases and hence the importance of reusing, redefining or challenging existing conventions to create new symbols and identities becomes relevant (Asheim et al, 2007). A symbolic knowledge base has a strong semiotic content and the importance of interpretation is high (Gertler, 2008, 2010). Symbolic knowledge is related, for example, to the dynamic development of cultural industries such as media (film making, publishing, music, etc.), advertising, design and fashion.

5 Data, methodology and the cases

5.1 Data

The gathering of data comprised several phases. First, the three regions and the nature of the case industries were mapped for identification of firms to be interviewed as well as the main policy instruments in use. The key firms were identified by drawing on existing knowledge of these clusters; membership lists of formal policy clusters, regional firm registries and cluster reports were analysed. Additionally, the programme director of the Intelligent Machines Cluster Programme was asked to name all the key companies of the respective cluster. In total, the sample of the Tampere case included 37 key firms of which 26 were interviewed. The sample of the South Ostrobothnia case included 27 key firms of which 18 were interviewed. As the digibusiness case in the Helsinki Metropolitan Area is significantly larger than the two others, the sample and, most notably the key firms, were selected by utilising the existing expert knowledge (and various cluster development programmes) and by stratified systematic sampling. In total the sample of the Helsinki case included 83 key firms and 51 of these were interviewed. The main aim was to reach the key firms of the cluster in question and of the sampled key firms, 70% in the Tampere region, 67% in South Ostrobothnia and 61% in Helsinki were interviewed.

Consequently, 95 firms in total were interviewed. Most of the 107 (in few cases there were two persons representing the firm) firm interviewees (65%) were entrepreneurs, owners of the firm or chairmen of the board and 8% were heads of R&D departments or the equivalent. The rest of the interviewees had miscellaneous working titles. The firm interviews were a combination of structured and thematic procedures. The structured interviews gathered information about the companies and their recruitment processes, knowledge flows, experience of policy programmes and innovation performance. The thematic part of the interviews focused on knowledge networks and the utilization of the innovation policy instruments. The interviewed firms were fairly small; 45% of the intelligent machinery firms employ 50 or fewer people and the digibusiness firms were even smaller.

TABLE 1. Employees of the interviewed firms (2005 and 2008)

	South Ostrobothnia (n=18)		**Tampere region (n=26)**		**Helsinki metropolitan area (n=51)**	
	Employees 2005	*Employees 2008*	*Employees 2005*	*Employees 2008*	*Employees 2005*	*Employees 2008*
Mean	49.9	60.2	179.9	225.7	106.8	112.3
Median	41.0	65.0	77.5	107.5	12.5	18.0
Standard dev.	44.6	51.5	283.1	276.7	504.3	464.1
Minimum	1	1	1	8	1	1
Maximum	160	180	1200	900	3500	3300

In the second interviewing phase, an additional series of interviews (53) was carried out in the context of international evaluation of the Finnish national innovation systems (Veugelers et al, 2009). These interviews focused on the national innovation system and policies and were carried out for another project and purpose. However, these interviews were reanalysed for this study and a specific focus was laid on understanding the overall change in Finnish innovation policy thinking.

In the third interviewing phase, 40 persons mainly responsible for local and regional innovation policy initiatives were interviewed in the three case regions. In addition, in Seinäjoki, a focus-group interview with six interviewees was organized. In all the three case locations two to four interviewees represented universities or other higher education institutions, two to three Centre of Expertise Programmes, and one to two local city governments. In addition, the local agent for Tekes[iii] was interviewed in all regions. Four interviews were carried out at the national innovation policy agencies; Tekes, Finnish Strategic Centre for Science, Technology and Innovation and Ministry of Employment and the Economy of Finland.

5.2 The cases – three regions, two industries

In this study, the Helsinki metropolitan area represents a complex and versatile metropolitan region with a fragmented regional innovation system. Being the only region in Finland that could be labelled as metropolitan with its population of 1,100,000 and having a very strong institutional and organizational basis with the main Finnish universities and R&D-oriented industries the Helsinki metropolitan area dominates the Finnish innovation scene in many ways. The specific case industry is digital content creation, digital production.

Digital knowledge is a new technology-intensive element in the industries, where the medium may be digital but the content, the value added for an end-user or customer, is symbolic, artistic or creative. There is no established definition of digital content creation or digital production. They cross through three relatively different branches of business: the ICT cluster (digital services and the channels to markets), creative industry (content and type of interaction with the customer) and knowledge-intensive business services (business services and the idea of formation of innovation systems). As the digital content business covers a wide range of individual but closely related or intertwined businesses and industries we refer here simply to 'digibusiness'. This covers all the production and design of products and services that are in a digital form; music, other sound, text, images or moving images that can be loaded or distributed through digital channels including the Internet, digital television, cellular networks and physical (mobile) products containing content in some digital form (Blomqvist et al, 2007).

In the Finnish digibusiness cluster, most of the enterprises are micro-firms employing from 2 to 9 employees. The cluster involves some major companies, whose focus is not exactly on producing digital content but rather on the creation of added value for their main products and services by digital services. Most of the digibusiness firms, around 49-62% (depending on the sub-field), are located in the Helsinki region (Helsinki Metropolitan Area Business Report, 2009; Helsinki Metropolitan Area Economic Development Working Group, 2009; Norrgård et al, 2009, 4-7).

Tampere represents here an old industrial city region. Its industrial roots date back to the early nineteenth century (see Kostiainen & Sotarauta, 2003). The population of the entire Tampere city region is approximately 365,000 and that of the city of Tampere approximately 211,000. Tampere has a share of about 16% of the R&D investments in Finland and it is the second-largest R&D hub after the Helsinki region. In Tampere, there are two universities and two polytechnics as well as some public research organizations like the Technical Research Centre of Finland. The case industry, machinery, is the largest industrial branch in the region with 17,200 employees. Its share of exports is 53% of all the exports from the region (Harmaakorpi et al, 2009, 51-52; Intelligent Machines Cluster Programme 2007-2013, 2009). Some of the main machine manufacturers in the Tampere region are global market-leading companies in their respective fields. Tampere is also the main centre of mobile machinery research in Finland, with almost 1,000 researchers at the Tampere University of Technology and the Technical Research Centre

of Finland (VTT). The specific form of intelligent machinery under scrutiny here, mobile heavy work machinery (in Tampere incl. container handling machines, drilling machines, forestry machines), is one of the largest specialized industrial clusters in Finland.

South Ostrobothnia is one of the most rural regions in Finland and consequently, from a regional innovation system perspective, it can be characterized as an organizationally thin regional innovation system (Sotarauta & Kosonen, 2004; Kosonen, 2007). South Ostrobothnia is a region with a strong agricultural tradition and rural entrepreneurship. The region has approximately 193,000 inhabitants. Owing to its economic structure, the South Ostrobothnian GDP per capita is only 74% of the national average (FINHEEC, 2009, 7.1). The region has not traditionally been among the leading technology regions in Finland but is among the least research and innovation-intensive Finnish regions (Kosonen, 2007). Similarly, the regional expenditure on R&D is low compared with that of other regions in Finland. In 2008, South Ostrobothnia represented only 0.4% of all the Finnish R&D (Statistics Finland, 2009). There are no independent universities but one polytechnic, and the University Consortium of Seinäjoki hosts small filial units of 6 different universities. Being the second-largest sector in the region, the machinery, metal manufacturing and technology industries in general offer nearly 9,500 jobs. Producers of agrotechnology comprise the manufacturers and developers of machinery, control and information systems (e.g. automation and software) to be used mainly in agriculture, forestry and the food industry, including primary production and vehicles for those areas. The regional agglomeration of agrotechnology (ICT and machinery) consists of around 120 firms with nearly 3,000 employees (in Finland as a whole 16,900 firms with 49,500 employees; source: Statistics Finland, 2009).

6 Nature of innovation process and policy in digibusiness

6.1 Restless dynamism is the name of the innovation game in digibusiness

The competitive advantage of the studied digibusiness firms is based mostly on customized production for individual customers. In addition to being customer-oriented all the interviewed firms also reported high innovation activity. A total of 84% of the digibusiness firms have introduced new or significantly improved products and/or services to the market and 81% of them reported that their new products or services were also new to the customer (see for more detail Sotarauta et al, 2011).

Many of the studied digibusiness firms consider themselves as research, development and innovation providers or innovation service providers as a whole, without any clear inter-firm divisional distinctions. The majority of the digibusiness firms (68%) report that they do not have any separate R&D units. This supports Cohendet and Simon (2008), who maintain that many of the modern knowledge-intensive firms do not have large R&D units or worldwide subsidiaries to tap into external knowledge, nor do they have many other classical ways to enhance creativity. Instead of in-house R&D units digibusiness firms rely on manifold networks to source new knowledge and ideas. They

also make extensive use of the Internet and other digital channels to stay in touch with a rapidly developing field; this includes the blogosphere, Twitter or the like, Facebook and various other virtual interactive spaces. As the digital world is undergoing constant and fast change the firms need to monitor and connect themselves to those networks that seem to provide the best platform for future development with the most promising and exciting potential as business opportunities.

It became obvious in the interviews that innovation processes in digibusiness are evolving rapidly and accumulating in many ways. The innovation leaders within the sector are constantly in search of new business ideas as well as new customer groups and novel forms of digital media. Additionally, constantly evolving business modes and working styles enhance the restless dynamism of the field (e.g. in audio-visual/motion picture, gaming and digital marketing). A wide set of professional and user communities is involved in exploring new customer needs or forms of service and/or in the process of imitation or co-created innovations. The identified business opportunities and/or best practices of other firms are tested rapidly and incorporated into the existing service portfolio of a firm. In digibusiness, being first in the market is an advantage but equally important, if not more, is branding the service or product and hosting visible references from various sources (design, brands, trademarks, social media references etc.). All this reflects the restless novelty seeking nature of the digibusinesses.

The interview data suggest that in the digital content and service cluster, new ideas and business opportunities are often shared or jointly explored with customers and partners. Digibusiness firms see customers and their demand as a driving force in business development and knowledge sourced from them as an immediate opportunity for business. The digibusiness firms induce or challenge their clients and customers to participate in the development processes in the early stages of the product and service life cycles, and therefore treat customer participation as one of the key development assets in the design of final products and artefacts. Due to the nature of the core knowledge base all this does not necessarily require heavy investments in equipment and infrastructure and both the partnerships and innovation efforts evolve more rapidly than for example in the two cases of intelligent machinery. Additionally, it is not at all unprecented for skilled developers to move to work for a competitor and/or for their customers. Consequently, both the firms and the highly skilled experts are constantly in search of something new, restlessly seeking new opportunities and knowledge sources. These observations are in line with Nachira et al (2007) who maintain that in digital business the actual slowly changing network of organizations is being replaced by more fluid, amorphous and often transitory structures based on alliances and partnerships.

6.2 Reactive gardening policy for digibusiness

The main aim of the innovation policies for the digibusiness cluster, in the spirit of the new national innovation strategy of Finland, is to direct the policy initiatives towards new business opportunities as well as user orientation and user experience.

Both our firm and policy interviews suggest that many of the current national innovation policy initiatives are not particularly useful for the actual creative work carried out in many of the digibusiness firms. At a strategic level Finnish innovation policy is taking steps towards a broader understanding of innovation systems as well as recognizing the specific needs of the firms drawing on a symbolic knowledge base, but many of the national innovation policy tools are still more geared towards technology and products and hence they suit better the firms drawing on synthetic and analytical knowledge bases than those drawing on a symbolic one. For example, the new Strategic Centres of Excellence for Science, Technology and Innovation (SHOK) programme is not seen as serving well the specific nature and needs of the digibusiness cluster. SHOKs are heavily research-oriented initiatives while the SME firms in the cluster are not. The threshold for SMEs to participate is too high in a situation in which the possible outcomes are unclear and the entire endeavour calls for long-term commitment to collective R&D in a field whose innovation processes are more based on a constant search with customers and partners than R&D as such.

The entire digibusiness cluster is such a heterogeneous entity that the designated policy agencies and responsible policy-makers see customization as both difficult and risky. The danger is that customized policies might lose sight of the complexity of the field in question and become too focused on a narrow part of the entire cluster or a specific need of some specific firms and hence the policies might not serve the development of digibusiness as a whole particularly well. This also reflects the rapidly evolving and differentiated – restless - nature of the field. Innovation policy aims to react with the different needs of different branches of digibusiness by gardening the generic conditions but also serving the specific needs by customized projects. Our policy interviewees stressed the need to keep policy initiatives as dynamic and agile as possible instead of having overly customized tools and/or large and comprehensive policy programmes. This includes the financial flexibility as a precondition for successful policy. This is exactly what the Centre of Expertise Programme aims to do and hence, as a flexible development programme, it serves the needs of the restless industry better than the SHOK programme.

Consequently, various policy initiatives targeted at the digibusiness cluster are usually deliberately left at a generic level and even vague so that emerging needs and purposes can be widely supported. This kind of local innovation policy practice comes close to the thinking of Hamel and Välikangas (2003) who propose that innovation can be bred via a decentralized funding system that emulates open markets. They claim that just as nature conducts many evolutionary experiments in order to have a successful species, so companies should fund many innovation projects and see which ones win out.

As Hamel and Välikangas simplify their point: '…if the range of strategic alternatives your company is exploring is significantly narrower than the breadth of change in the environment, your business is going to be a victim of turbulence' (Hamel & Välikangas 2003, 4). In the same vain, the policy aims to create a vague and shifting

innovation space that is open to quick action and fresh interpretation of the constantly emerging landscape. In a way the lead idea is to garden all the perfectible ideas by supporting experimentation and then filtering the most potential and valued ideas from the whole myriad of ideas and finally passing them to the most suitable national level funding channels and supporting systems. The main tools for these purposes in the digibusiness cluster are 'growth coaching', 'international coaching on how to go global', 'project coaching', seminars, workshops, briefings, network building, exhibitions and fairs.

Due to the dynamic nature of the field many of the established national institutions such as universities, research centres or governmental offices are not usually regarded by the firms as fast and exciting enough to be linked to as partners. However, the main institutions are regarded as important normative bodies that may change the playground in favour of the sector. They are also customers with whom many digibusiness firms work in collaboration to produce new solutions (e.g. for municipalities in the Helsinki metropolitan area). The approach adapted for the promotion of digibusiness also relies on the perceived fact that in a relatively small homogenous country it is fairly easy to create cross-sectoral policy platforms and bring people together from different walks of digibusiness. Digibusiness firms and related policies have already reached for the welfare, sports and transportation sectors as well as the experience and entertainment industries. Digibusiness firms, operating in a fairly low capital investment field and being heavily dependent on human capital, can move relatively easily from sector to sector and test their services and products in different user communities.

The agility and vagueness emphasized by the local policy community is somewhat in contrast to a fairly common criticism that the Finnish innovation system is overly complex with multiple small intermediary organizations and policy initiatives (Veugelers et al, 2009). It seems that for local/regional policy officers small is agile, flexible and customized while for the national level policy officers smallness is a sign of fragmentation and a lack of strength. Consequently, in the efforts to promote digibusiness in the Helsinki metropolitan area, customization occurs at a project level but the framework provided by a wider cluster programme is left generic and not well focused a priori. In a way, in the case of digibusiness, the implementation of a local/regional innovation policy can be interpreted as a filtering process in which firms and policy officers are collaboratively screening a whole variety of ideas and support is directed to those ideas that emerge as the most viable ones.

7 Nature of the innovation processes and policy in intelligent machinery

7.1 Solid engineering is the name of the innovation game in mobile heavy machinery and agrotechnology

The mobile heavy work machinery industry is a combination of companies manufacturing and/or developing machines and research organizations researching and developing related technologies. Generally speaking, the competitiveness of the cluster is based on adding 'intelligence' to traditional machines such as drilling machines, container-handling machines, safety-glass machines and machinery for agriculture by integrating knowledge on the respective markets, hydraulics, control systems, optical systems, automation, information and communication technology, electronics and software engineering. As is the case with digibusiness too, the studied engineering firms both in Tampere and in South Ostrobothnia base their competitive advantage mostly on customized production for individual customers (see for more detail Sotarauta et al, 2011). Although the machinery industry has faced difficulties during the recent decades, it has been able to recreate itself and the key to its survival has been the infusion of new technologies into traditional machine building by the improved innovation capabilities of the companies and intensive co-operation with knowledge-producing organizations, most notably the Tampere University of Technology and VTT Technical Research Centre of Finland (Martinez-Vela & Viljamaa, 2007, 3). The engineering-based mobile heavy machinery cluster in Tampere represents the classical way with its strong research and development orientation that is reflected in the fact that 81% of the interviewed firms have an R&D unit while in the other two cases only one third of the firms have one. The number of employees working on R&D is relatively small in all three cases but is the highest in mobile heavy machinery of Tampere. Intelligent machinery firms consider R&D divisions mainly as a means a) to channel knowledge from customers and other sources to the firm and b) to interpret the significance of the obtained knowledge about the needs of the customers.

As was the case with the digibusiness firms, most of the studied engineering firms consider themselves as research, development and innovation providers or innovation service providers without any clear inter-firm divisional distinctions. From the customer point of view the products are a mixture of solutions and industrial services. According to the innovation policy officers, the intelligent machinery firms draw new knowledge from on-the-site, face-to-face and hands on interactive processes with their customers. The main aim of this kind of approach is to co-construct a joint understanding and interpretation of the needed products and services as well as innovations related to them. It is fairly common that intelligent machinery teams aiming for a new innovation may involve a wide array of experts from the firm, customers, other firms and supporting organizations. R&D personnel or those responsible for customer development may spend weeks, months or even years within customers' facilities or working environments (forests, fields, barns, factories etc.), monitoring the work carried out at the site.

The core motivation is to detect, analyse and interpret the needs of a customer and possible changes in the products, processes and/or services that a customer might value. For mobile heavy machinery firms this culminates in a view of customers as sources of new ideas and knowledge the main aim being to enhance the long-term customer relations. The industry seeks continuity to cope with global markets. The way mobile heavy machinery firms innovate is solid and long-term in comparison to the restless and fast evolving processes of the digibusiness firms.

7.2 The core of the innovation policy: Customized collaboration in Tampere and catching up in South Ostrobothnia

Both mobile heavy machinery in the Tampere region and agrotechnology in South Ostrobothnia represent very different clusters from the digibusiness in the Helsinki metropolitan area. They are engineering-oriented entities that fairly clearly draw upon synthetic knowledge bases. If the policy initiatives are more generic and reactive than focused and pre-customized in the context of digibusiness, in both of the engineering cases policies have many symptoms of being customized, proactive and even fine-tuned. Policies targeted at intelligent machinery focus on applied research while innovation policies targeted at digibusiness are more oriented towards creativity and concept creation, branding and finding a proper media platform. In intelligent machinery, policies highlight multifying investments, launching long-term joint research programmes and projects and establishing new jointly owned specialized R&D organizations and here the rationale of the SHOK-programme fits well in the innovation practices of the firms, prevailing policy thinking and its repertoire. It is very common for the development agencies to meet the members of respective clusters regularly and hence the needs of specific firms as well as the entire cluster are continuously discussed in various forums (both formally and informally).

One of the main aims within the Competence Cluster for Intelligent Machines programme of the Centre of Expertise Programme, especially in the Tampere region but also in South Ostrobothnia, is to expand and enhance the quality and quantity of R&D, both in the firms and in the universities, so that they would develop from a good regional/national level to a European and international level. For this purpose, the key policy actors visit fairs, exhibitions and conferences to learn trends and new knowledge and search for knowledge or possible partners from the research organizations for the firms. The main policy ambition is to enhance conditions for generation of applied research-based knowledge that is generic enough for several companies to exploit and adjust to their own needs. Tampere University of Technology and the Technical Research Center of Finland (VTT) are playing a central role in creating and maintaining this kind of knowledge base with the firms (see also Martinez-Vela & Viljamaa, 2007).

Interestingly, in these regions firms may be in collaboration with each other on fairly specific issues within a given policy context. Partly this is due to the fact that the main firms use more or less the same generic technologies but compete in different markets.

Therefore, there are no competition-based reasons for not co-operating in technology development. Co-operation between firms has become an issue only in few cases, most notably in cases where a foreign owned multinational company and a Finnish one have not been able to share policy-related projects.

In addition to the generation of research-based knowledge internationalization is among the main development targets. So far, local and/or national research organizations have been the main sources of knowledge (Sotarauta et al 2011) but it is rather generally agreed on that the local research capacity needs to be complemented with operative links to foreign universities. For this purpose, in the Forum for Intelligent Machinery (FIMA) framework, European universities are screened to find those universities that might complement the expertise of the local universities in Tampere and to find ways to establish joint projects.

If in digibusiness it was stressed that the policy initiatives need to be kept generic and flexible, the situation is almost the reverse in intelligent machinery. Customized innovation policies are called for both by policy officers and by firms, and research and development projects are geared to serve the specific needs arising from the firms. It was stressed in the interviews that if the policies remain at a general level, they do not serve the companies well enough and end up being wasted money. It was also stressed that the resources for different development efforts are scarce and hence policies ought to be selective and customized. Additionally, it was seen that with the aim of becoming 'the best in the world' suitable niches ought to be found not only by the firms but also by the policies. However, as the critical voices argued in the interviews, if the policies become overly fine-tuned and customized they may lead to too narrow and short-term a focus in many of the development efforts and lead to lock-in situations. If this happens, new ideas and initiatives are often put aside in a situation where investments in the existing technology and competences gain visibility and high expectations.

During the last 15 years, the policy emphasis in South Ostrobothnia has been on raising institutional capacity by integrating small university filials into a university consortium, founding and strengthening Seinäjoki Polytechnic as the only locally owned and independent higher education institute, enhancing development and innovation services by founding new specialized development agencies and building a local science park (Sotarauta & Kosonen, 2004; Kosonen, 2007). In South Ostrobothnia, one of the main targets has been to create better functioning connections to the Finnish universities (especially in Tampere, Helsinki and Vaasa) and for this purpose a specific network of professors was designed and implemented in the early 2000s (see Sotarauta & Kosonen, 2004). More specifically, the main tools for enhancing innovation have included innovation vouchers, coaching, briefings and project formulation. The local policy community has also established virtual networks for agrotechnology firms, an agrotechnology living lab and a smart systems annual conference and organized seminars, exhibitions and fairs.

Both in Tampere and in South Ostrobothnia, our policy interviewees highlight open interaction, cross-disciplinary applied research, joint ventures and consequently less in-house research and development. They believe that instead of purely developing machines and concrete products the competitive potential lies more in the abstract features of products: services, user and customer experience, increased interactive products and service development with customers, virtual customer forums and tailored services etc. All this indicates efforts to recognise better the needs of the end-users.

8 Conclusion

The study reported in this paper shows, first of all, that in the Finnish innovation policy community, there is a fairly shared understanding that policies ought to be facilitative, system-oriented, network promoting and indirect in nature. There also is a strengthening trend that emphasizes customer and user orientation stressed side by side with science and technology. The second observation is that in spite of a shared understanding of generic principles the main policy programmes and their regional applications are clearly customized to serve specific clusters, and they focus on overcoming the specific bottlenecks of the regional innovation systems and/or industry in question. Much of the customization is carried out at a local/regional level on the one hand and local/regional level actors also create novel solutions in the context of a national policy thus changing it on the other hand.

Consequently, this study supports Mytelka and Smith (2002, 1477), who maintain that if stakeholders at the regional level are able to shape policies directly through participatory processes, there is a possibility of customizing new policy instruments to the particular habits and practices of the actors whose behaviour the policy is designed to influence. What this study does not reveal, however, is the nature and dynamics of the co-operation within the policy communities; whether it is conflict free or not (see Roberts 2006).

Third, the cases studied here indicate that both innovation processes and policies differ along the knowledge bases and regional innovation system types. The innovation strategy for digibusiness is a '360 degree reactive strategy' with a loose focus. It reflects the dynamic nature of the digibusiness industry by aiming to match it by creating a vague and shifting innovation space that is open to quick action and fresh interpretation of the constantly emerging landscape. The risk here is that the policy focuses on an overly short-term view. The strategy also aims to reduce fragmentation in the innovation system.

Policy initiatives supporting intelligent machinery in Tampere are customized, proactive and collaborative in nature. The main aim is to maintain and increase R&D intensity with a generic technology focus that firms can apply according to their own strategies. Rather than aiming to overcome some specific bottlenecks the policies aim more to enhance existing strengths of the regional innovation system and connect the industry into extra-regional knowledge networks. There is, however, an emerging

dilemma: to fine-tune or not to fine-tune. If the knowledge base is fine-tuned to its extremes, the industry may end up being locked in the existing competence instead of renewing them. There is an emerging discussion on whether more emphasis ought to be laid on cross-sectoral co-operation. In South Ostrobothnia, the policy emphasis has been on increasing the institutional thickness and innovation capacity with an emphasis on learning to innovate and building links to the main innovation centres of Finland. The entire policy mix focuses on overcoming the bottlenecks of an organisationally thin regional innovation system.

In all three case regions the major policy decisions are negotiated in multi-actor arenas and related networks (state–region–municipality–firm–university–polytechnic) and hence they represent a Finnish version of the multi-actor innovation policy arenas (Kuhlmann, 2001). Consequently, multi-actor forms of innovation policy challenge the straightforward definitions of innovation policy that see innovation policy as something only the public sector performs alone. Simultaneous broadening and customizing innovation policies as well as a blurred borderline between policy-makers and other actors suggest that firms and universities are not only beneficiaries of the policy but also active members in its design. Our observations on the nature of innovation policy processes point towards a broader definition of innovation policy and not only of innovation systems.

Most importantly, fourth, this study shows that identification of different knowledge bases may help in creating a match between a region and/or an industry and respective innovation policies. Regional innovation systems do not differ only along regions and industries but also differentiated knowledge bases. All this suggests that it is important to identify and understand innovation as well as innovation policy dynamics instead of focusing only on structures, development programs, funding mechanisms and straightforward policy tools.

TABLE 2. Summary of the investigated innovation policies

	DigiBusiness (Helsinki Metropolitan Area)	**Mobile heavy machinery** (Tampere Region)	**Agrotechnology** (South Ostrobothnia)
Nature of the concentration	- Music, text, images loaded or distributed through various digital channels - Heterogeneous and fast developing with mainly micro-firms	- Machine building (e.g. drilling machines, container handling machines, forestry machines) - Mature with several global market leaders	- Manufacturers and developers of machinery, and control and information systems for agriculture, forestry and food industry - Mature with national focus
Innovation policy philosophy	- 'Don't know what to focus on, let us experiment with everything interesting to find a new path'	- 'Fine-tuning is compulsory for success'	- 'This is a less-favoured region in innovation but let us strengthen our innovation capacity'
Nature of the policy	- Reactive gardening policy - Loosely defined policies, space for experimentation, rapid reaction and collective learning	- Highly focused and customized, collaborative	- Proactive catch-up policy with novel solutions
Main objective	- Creation of awareness of a rapidly emerging industry - Reduction of fragmentation and fostering co-operation among main actors	- Maintaining and increasing R&D intensity to become an internationally recognized knowledge hub	- Increasing local innovation capacity, learning to innovate
Focus and customization	- Focus on growth oriented SMEs and boosting interaction between SMEs and large firms - Customization is a continuous bottom-up process - projects stem out from firms' needs	- Generic technology focus for firm specific applications, applied research - Large firm dominated - Customization is a constant act of balancing	- Focus on the local innovation system and capacity – applied research and services for firms - Customization is a constant act of balancing
Strengths and weaknesses of the policy approach	- Strengths: Fits well with the nature of the cluster; dynamic bottom-up approach - Weakness: May lead to short-termism	- Strengths: Close co-operation between the industry, research and policy community; long-term but pragmatic focus - Weakness: May lead to excessive fine-tuning of existing knowledge base instead of searching for new ones	- Strengths: Effective use of scarce resources; close co-operation between main actors at a local and regional level - Weakness: thin and temporary (project-based) structure; lot of time and energy spent in maintaining the RIS

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[i] The Centre of Expertise Programme that has operated in the nexus of regional development and innovation policies since 1994 is the only innovation-related programme with an explicit regional focus. The annual national funding for the CoE programme is appr. € 20 million, which is catalyst funding by nature. The overriding objective of the programme is to increase regional specialization and to strengthen cooperation between regional centres of expertise. The National Programme involves 13 national Competence Clusters and 21 regional Centres of Expertise'. With competence clusters the aim is to create a 'managed network' for enhancing the respective cluster. (Pelkonen et al, 2010).

[ii] The Strategic Centres for Science, Technology and Innovation (SHOK) with annual funding of appr. € 300 million are believed to provide a new way of coordinating dispersed research resources (see Edquist et al, 2009). Each of the strategic centres needs to be established in collaboration between companies, research organizations (universities, research centres) and funding agencies. It mobilizes the relevant actors in the field, the aim being to carry out research programme that is designed by the core companies and the participating research organizations. (Edquist et al, 2009).

[iii] The Finnish Funding Agency for Technology and Innovation (Tekes) is the main public funding organization for research and development (R&D) in Finland and it channels appr. € 600 million annually to research and development work. Tekes allocates about half of its funding to companies, universities and research institutes through Tekes programmes.